State of Illinois
Department of Registration and Education
STATE GEOLOGICAL SURVEY DIVISION
John C. Frye, Chief

GUIDE LEAFLET

GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY, URBANA

GRAFTON AREA

Jersey County
Jerseyville, Hardin, St. Charles, and Brussels Quadrangles

Leaders
George M. Wilson and I. Edgar Odom
Urbana, Illinois
May 7, 1960

GUIDE LEAFLET 1960B

HOST: Grafton School

GRAFTON GEOLOGICAL SCIENCE FIELD TRIP

Itinerary

0.0	0.0	Assemble at southeast corner of Grafton School. Enter Rt. 100. Continue east to stop sign.
0.1	0.1	STOP. Turn left on Rt. 100. At Grafton numerous specimens of trilobites have been found in rocks of Silurian age. At present, however, they are hard to find. Continue north on Rt. 100 up Jersey Hollow.
0.2	0.3	Note outcrop of loess on the left.
0.2	0.5	Silurian dolomite outcropping on the left. The Silurian System at Grafton consists of the Edgewood, Kankakee, and Joliet Formations with a combined thickness of 105 feet.
0.1	0.6	Silurian dolomite on the right. Specimens of cystoids have been found here.
0.2	0.8	Note that a landslide has occurred on the left.
0.4	1.2	The top of the Silurian System. The Silurian is overlain by the Devonian Cedar Valley Limestone. This in turn is overlain by the Mississippian Sylamore Sandstone (4 inches); Glen Park Formation (1 foot); Hannibal Shale (25 feet); Chouteau Limestone (55 feet); Sedalia Limestone (7 feet); Fern Glen Limestone (20 feet); and the Burlington Limestone (45 feet).
0.1	1.3	Hannibal Shale on right.
0.1	1.4	Chouteau Limestone on right.
0.1	1.5	Sedalia Limestone on right.
0.1	1.6	Fern Glen Limestone on right.
0.1	1.7	Burlington Limestone on left.
0.1	1.8	The last of the Mississippian outcrops. Loess mantles the remainder of the upland.
0.5	2.3	Crest of the hill. Note the rounded character of the upland which is mantled with loess.

In the Pleistocene Period (or "Great Ice Age") North America experienced four successive glacial invasions, each separated by long intervals of mild climate. Of these four invasions, the earliest, the Nebraskan, may have extended southward to the vicinity of Pittsfield, in Pike County. The second, or Kansan invasion, moving down from the region east of Hudson Bay, extended over the area east of Grafton.

When the Kansan ice sheet melted away, it left behind deposits of glacial drift which mantled the surface and concealed the bedrock. There followed a long interglacial interval (the Yarmouthian Age), which left its record in the form of old soils and weathered zones in the Kansan glacial drift. From the amount of weathering and leaching that affected the Kansan drift, the length of the Yarmouthian Age is estimated from 200,000 to 300,000 years.

The Yarmouthian Age ended with the advance of a new glacier from a center east of Hudson Bay. This glacier, called the Illinoian, covered nearly all of Illinois. Its western edge coincided closely with the western boundary of the state. Grafton is within two or three miles of the western limit of Illinoian glaciation, which here extended a few miles into Missouri.

After several thousand years, the climate warmed causing the Illinoian Glacier to melt away. During this warm age, the Sangamonian, the upper part of the Illinoian till was weathered and soils developed, as in the preceding Yarmouthian interval. However, the Sangamon Soils are less intensely weathered than the Yarmouthian Soils, so the Sangamonian weathering interval is estimated to have lasted only about 150,000 years.

The Sangamonian Age ended when the fourth and final readvance of the glaciers occurred. This glacier, called the Wisconsinan, never reached the Grafton area. However, the Mississippi and other streams were choked with sediment washed out from the ice that stood to the north and east. The frigid blasts that whipped across these broad sand and mud flats blew dust over the uplands, covering the Illinoian drift and the Sangamon Soils with a thick layer of loess. The loess is an important component of present-day soils in the Grafton area.

2.0 4.3 Note the high ridge to the left, at a distance of about three quarters of a mile. This is an Illinoian morainal ridge.

0.9 5.2 SLOW. Turn right (south). Entering the Elsah blacktop road.

0.3 5.5 Note the good conservation practice on the hill on the far right, where there are grassed waterways on the steeper portions of the hill.

0.4 5.9 Note the grassed waterways.

0.5 6.4 Note the sinkholes on the right. Sinkholes are common features of regions underlain by limestone bedrock.

0.8 7.2 SLOW. Turn right on road to Chautauqua.

0.1 7.3 Sinkholes on right and left.

0.1 7.4 Note the loess on the upper portion of the hill with the soil profile developed in the upper five or six feet of loess. Note the chert pebble band immediately beneath it and overlying some 15 to 18 feet of deeply weathered Illinoian till. At the base of this cut is an outcrop of Mississippian limestone of Burlington age. West of this exposure note the great accumulation of cherty residuum on the north side of the road. The Burlington in this section of the country is quite cherty.

0.8 8.2 SLOW. Enter the New Piasa Chautauqua Grounds. Follow the main road into the Chautauqua Grounds area.

0.3 8.5 Stop 1A. Chautauqua Spring. Unconformity between the Chouteau and Sedalia Limestones.

Lower Mississippian strata of Valmeyer and Kinderhook age are well exposed in the cliffs that border the Mississippi River in the vincinity of Chautauqua. The section exposed above the spring at Chautauqua is of special interest because it reveals an unconformable surface between the Chouteau Limestone of Kinderhook age and the Sedalia Limestone of Valmeyer age.

The tilted Chouteau Limestone was originally deposited in a horizontal position. Following its deposition this region was disturbed by a mild deformation which tilted the Chouteau beds toward the north. Erosion planed off the tops of the tilted beds, and later the Sedalia Limestone was laid down horizontally upon these tilted beds.

An unconformity is an important criterion used to divide the rock column into units of different ages. Usually unconformities indicate that a region was raised above sea level and subjected to weathering and erosion. The unconformity exposed here between the Choteau and Sedalia Limestones marks the boundary between the Kinderhook and Valmeyer Series of the Mississippian System, and indicates that at least in this local area there was a period of erosion between the deposition of the Chouteau and Sedalia Limestones. The unconformity is very local, for only a few miles to the north no unconformity can be recognized.

Chautauqua lies near the margin of the Illinois Basin. Unconformities usually are abundant near the margins of sedimentary basins because the seas were often shallow or not present at all, while in the deep portion of the basin seas were present almost continuously. When geologists attempt to trace unconformities into the Illinois Basin, they find that most of them disappear.

Springs are often seen in areas underlain by limestone bedrock. Springs are fed by rain water that goes underground through joints and crevices in the limestone. This water cannot penetrate lower than the water table, which usually is determined by the major streams in the area. This spring emerges at about the level of the Mississippi River along a well-developed joint plane.

0.0 8.5 Turn around. Retracing route to Rt. 100.

0.3 8.8 STOP. Turn left (north).

1.9 10.7 Stop for Rt. 100. Turn right (east). Continue across the Jersey County upland.

1.5 12.2 Note the grassed waterways on the left.

0.2 12.4 Note the outcrop of the Salem Limestone on right and left.

1.1 13.5 Note the outcrop of the Salem Limestone in the stream on the right.

0.1 13.6 Note the Salem Limestone on the left.

0.3 13.9 STOP. Turn left. Enter Rt. 109. CAUTION.

0.9 14.8 SLOW.

0.1 14.9 Turn left to Dow (west). We are approaching a morainic remnant of Illinoian age some 70 feet high. This particular spot allows an excellent view of the Jersey County countryside, especially of the moraines that are here. The surface is loess covered and the soil developed in the loess.

0.9 15.8 Stop 1B. Discussion of Illinoian Glaciation.

On this hill the loess and till have a combined thickness of more than 100 feet while on the general upland surface they have a thickness of less than 60 feet. This knoll may be identified as a morainal feature

belonging to a series of similar knolls in this section of the country with a northwest-southeast trend. The margin of the Illinoian was not far west of this spot--possibly only three or four miles.

0.3 16.1 SLOW. Crossroads. Turn left (south).

0.6 16.7 SLOW. Turn right (west).

0.1 16.8 SLOW. Turn left (south).

0.3 17.1 Note the outcrop of the Warsaw Shale on the right and left.

0.2 17.1 Stop 2. Walk to Rt. 100. Go to the right, descending toward the stream. The limestone along the roadcut is the Salem Limestone, the same limestone that is extensively quarried in southern Indiana for use in the building of houses in the Middle West. This is the best outcrop of the Salem in the Grafton area. Here it is 15 to 18 feet thick and very pure. However, cavities filled with calcite are found in this section of the country. In the stream bed is the Warsaw Shale, which in western Illinois contains many geodes. The Warsaw here contains geodes filled with minerals, such as quartz, chalcedony, calcite, chalcopyrite, malachite, kaolinite, dolomite, and ankerite. The origin of these geodes is uncertain.

5.1 22.2 Start descent of Jersey Hollow, traversing the geological column beginning with loess at the top, accumulated cherty residuum on top of bedrock, and the Mississippian, Devonian, and Silurian Systems.

0.8 23.0 Note the cavern in the Hannibal Shale.

1.2 24.2 STOP. Turn right on Rt. 100.

0.2 24.4 Silurian dolomite on the right. Note the massive characteristics of this dolomite.

0.7 25.1 Note the combined thickness of the Silurian dolomite and the overlying Mississippian rocks. The first big ledge, about 80 to 90 feet above the level of the road, is the top of the Silurian System.

0.6 25.7 Note the buildings on the right built with Silurian dolomite.

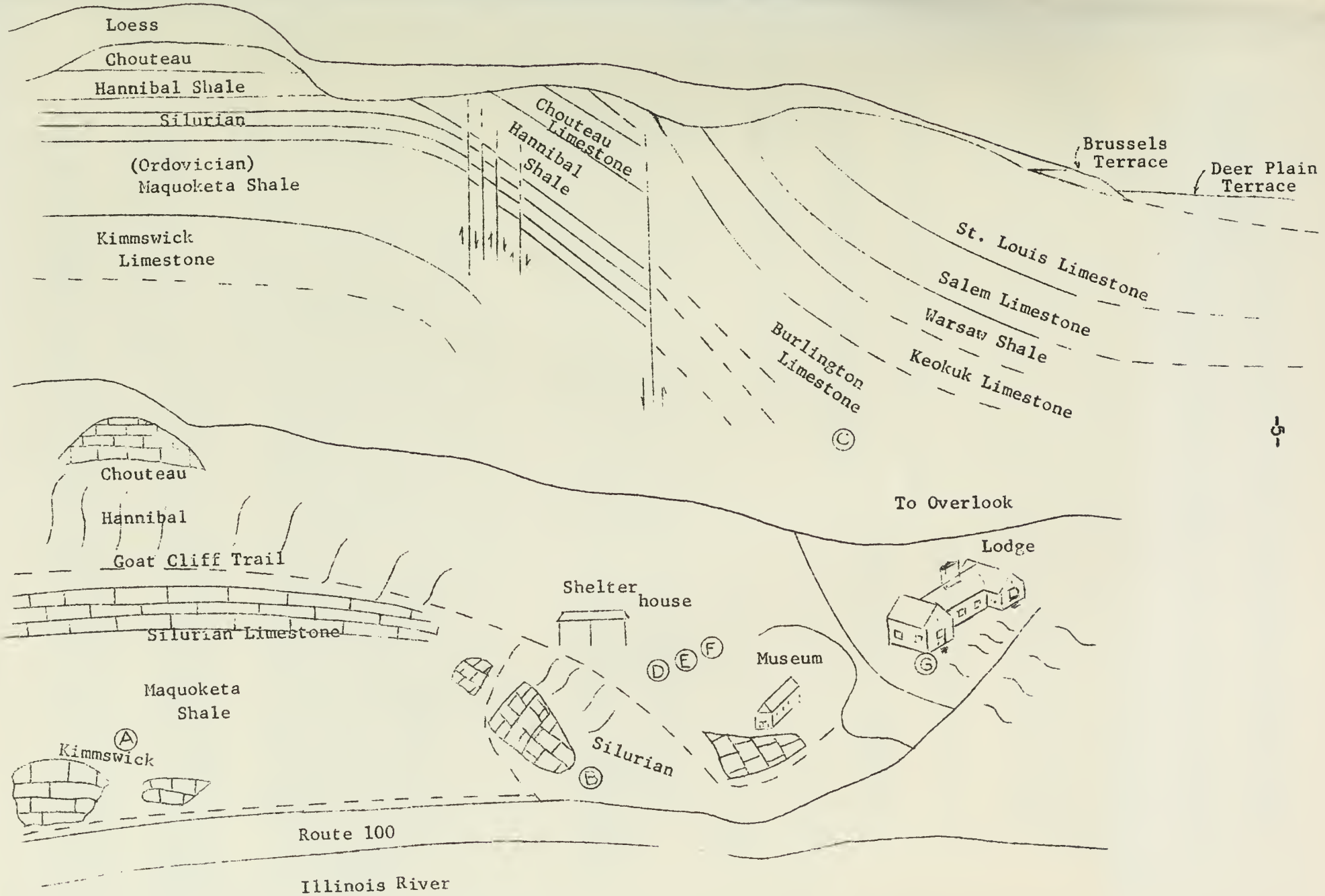
0.2 25.9 The Father Marquette Memorial commemorates the first recorded entrance in 1673 of white men into the Illinois country. In the spring of 1673, Louis Joliet and the Jesuit priest, Father Jacques Marquette, were sent by the French Government over the Wisconsin portage to explore the Mississippi River for a passage to the Pacific Ocean. They travelled as far as the Arkansas River, where they turned back. In September they entered the Illinois River, making camp at this spot. Father Marquette noted the event in his journal on the trip, thus making it the first recorded entrance of white men into the Illinois country.

0.6 26.5 Note the Silurian dolomite, dipping to the north. Geologists believe the rocks here are inclined in this direction because of slumping.

0.9 27.4 Note the very steep (about 75°) south dip of the rocks here.

0.2 27.6 The rocks here dip at an angle of more than 65 degrees south.

0.1 27.7 Here the rocks dip about 45 degrees south.


Loess
Chouteau
Hannibal Shale
Silurian
(Ordovician)
Maquoketa Shale
Kimmswick
Limestone
Chouteau
Limestone
Hannibal
Shale
Brussels
Terrace
Deer Plain
Terrace
St. Louis Limestone
Salem Limestone
Warsaw Shale
Keokuk Limestone
Burlington
Limestone
C
Chouteau
Hannibal
Goat Cliff Trail
Silurian Limestone
To Overlook
Lodge
Shelter house
D
E
F
Museum
G
Maquoketa
Shale
A
Kimmswick
Silurian
B
Route 100
Illinois River

.2 27.9 Note the well-developed joints and the slickensides developed on the bedding planes.

.1 28.0 Stop 3. Discussion of the intense folding of the rocks and structures on the Cap au Gres Structure.

After considerable discussion, geologists have decided that the rocks here shall be tentatively identified as Ste. Genevieve. According to the United States Geological Survey Professional Paper 218, William W. Rubey, 1952, they are Keokuk, while others have lumped them into the Valmeyer Series of Mississippian age. As early as 1947, Dr. Raasch identified these rocks as Ste. Genevieve. The reason for this uncertainty of correlation is that this is an isolated outcrop in a faulted and folded structure, and no continuity can be assured.

A few hundred feet west the rocks in Deer Creek Hollow are of Ordovician age of the Kimmswick Formation.

Note the slickensided surfaces on bedding planes, crumpling of incompetent beds, faulting, and mineralization. The structure of the Cap au Gres Fold is most striking.

1.1 29.1 Note the upper terrace surface in the pasture on the right, some 40 feet higher than the road level.

0.8 29.9 SLOW. Enter the Pere Marquette State Park picnic area No. 1 for lunch.

Stop 4. Lunch. We will not go into the park, because time will not permit us to make the long trip, or series of trips, that would be necessary to learn of all of the geology in this park. We suggest, however, that you might make trips on foot some other time. The lunch area, as well as the Lodge, are on the Deer Plain terrace of Wisconsinan age. You may follow the trails according to the plan shown on the preceding page.

Suggested Stops in the Park

Stop 4A. Kimmswick and Maquoketa Formations (Ordovician).

The oldest rocks exposed in the Pere Marquette Park are of Middle Ordovician age. The Kimmswick Formation outcrops in small exposures along Rt. 100 north of the park entrance. The formation is approximately 70 feet thick in the vicinity of the park, but only a few feet are easily visible. The limestone is exceptionally pure and is gray-white in color. Upon weathering, the rock becomes quite rough on outcrop surfaces, allowing lichen to gain an easy foothold. The Kimmswick on fresh fractures has a highly petroliferous odor, and only a few miles away (at Dupo and Waterloo) it produces oil.

Lying above the Kimmswick is the gray-green, weak, dolomitic, platy Maquoketa Shale. This shale weathers readily and gives rise to rather gentle slopes which are often tree covered. In some places dolomite beds are found in this shale.

The Maquoketa is unconformably overlain by an 80-foot section of Silurian dolomite exposed at a place called Goat Cliff. The Silurian is in turn unconformably overlain by the gray, silty Hannibal Shale. At

the south end of Goat Cliff, 600-800 feet from Twin Springs, the Silurian starts to dip southward into the Cap au Gres Monocline. The outcrops are marked, however, by slump, talus and loess.

Stop 4B. Twin Springs (Silurian, Devonian, and Mississippian Systems).

The Silurian dolomites are found at road level at Twin Springs, striking approximately east-west and dipping about 28 degrees south. There are at least 5 faults in the Twin Springs outcrop itself. The fault planes strike east-west but dip at approximately 65 degrees north, perpendicular to the beds of rock. In the preceding figure, this series of outcrops is diagrammatically shown. The rocks are strongly faulted with special features to be seen.

In this series of Silurian rocks, there are three formations which can be identified: the oldest Silurian (Alexandrian) is represented by the Edgewood and Kankakee Dolomites, and the middle Silurian (Niagaran) is represented by the Joliet Dolomite.

The Middle Devonian Cedar Valley Formation consisting of fossiliferous limestone and the lower Mississippian (Kinderhook) Hannibal Shale also are found. Rocks occurring in three systems are found in the immediate area of Twin Springs.

From the evidence found in this series of outcrops, geologists conclude that there was movement along the Cap au Gres Structure at more than one time, but specifically movement occurred during post-Devonian and pre-Mississippian time.

Stop 4C. Lookout Point physiographic study.

Look westward across the Illinois River toward Calhoun County. The hills in the distance rise some 400 feet above the river, whereas they rise nearly 450 feet above the river on the Jersey County side.

Across the river to the west is the Deer Plain Terrace of the Wisconsinan Age of glaciation, the Valderan Sub-age. The terrace slopes approximately 15-20 feet per mile away from the base of the bluffs. The next terrace above the Deer Plain is the Brussels of the Illinoian Age of glaciation. This terrace is easily seen from Greenbay Hollow, which is developed on the crest of the Cap au Gres - Lincoln Anticline.

The upland surface in this section of the country has been identified by Rubey (1952, Geology and Mineral Resources of the Hardin and Brussels Quadrangles) as a peneplain surface. He correlated this surface with the Lancaster Peneplain of the Driftless Area of northwestern Illinois, southwestern Wisconsin, and northwestern Iowa. On this upland surface area cherty gravels are widespread and may be of Tertiary age (Grover).

In looking across the Illinois Valley, note that the upland surface of the area lying south of Greenbay Hollow is approximately 175 feet lower than the area north of the Greenbay Hollow. Since the previously mentioned gravels are present on both the north and south sides of the Cap au Gres Fold, geologists would infer, as did Rubey (1952, Prof. Paper 218), that folding continued after the deposition of the brown chert gravels.

Stop 4D. Mississippian (Warsaw) geodes.

South of the shelterhouse there is a deep re-entrant in the bluff line which marks the position of the Warsaw Shale in the Cap au Gres Structure. Because of the weakness of the shale and because of folding, the shale does not show at the surface, but there are many geodes (rounded chert balls). However, they are not highly prized by collectors, because most of them are completely filled with chert or chalcedony.

Stop 4E. Mississippian limestone (Salem and Lower St. Louis).

The Salem Limestone here is composed almost entirely of the shell remains of minute animals that lived during the deposition of this limestone. The rock outcrops along a trail in a long, narrow, steeply dipping outcrop just south of the Warsaw re-entrant.

South of this ridge the St. Louis Limestone outcrops.

Stop 4F. Mississippian St. Louis Limestone and Upper St. Louis and possibly Ste. Genevieve Limestones.

At this stop, the trail descends past a nearly complete section of the St. Louis Limestone. The formation here dips 26 degrees south and is composed of angular fragments of fine calcarenite and lithographic limestone with particle sizes varying from pebbles to boulders. This breccia zone may also be found in southeastern Iowa, northeastern Missouri, and western Illinois.

Overlying the breccia, some 70 feet of limestone can be seen along the trail to the museum. The upper portion of this section closely resembles the rocks found in Stop 3.

In some zones, the St. Louis is quite fossiliferous, and some of the fossils include corals and brachiopods.

Stop 4G. Pleistocene and Physiography.

The lodge is situated on the Brussels Terrace, which is composed of interbedded sand and silt that was deposited in a lake when the ice of the Illinoian Glacier blocked the Mississippi River in the vicinity of St. Louis.

The Deer Plain Terrace (Rubey, 1952, Prof. Paper 218, p. 90-96) is a valley train deposit of late Wisconsinan (Valderan) glacial outwash heading in the upper reaches of the Mississippi Valley. It consists of gravels, sand, and silt. This is considered the last valley train deposit in the Mississippi Valley and these materials are not loess covered. The Deer Plain deposits are especially well developed in the Mississippi Valley.

0.2 30.1 T-road east. Turn left (south).

0.1 30.2 STOP. Enter Rt. 100. Turn right (west).

0.3 30.5 Note the Pere Marquette Lodge on right.

0.3 30.8 Note the inclination of the rock on the right-hand side for the next three-tenths of a mile. Shear zones and intraformational breccias observed in these rocks attest to the strong forces that acted in the formation of the Cap au Gres Fold. This structure is a faulted fold. Occasionally, the

rocks in this section are standing vertically, although the average dip of the rocks in this portion of the fold ranges from 20 to 75 degrees.

).4 31.2 Note the limestone on the right; this is the Kimmswick Limestone of Ordovician age. This limestone is overlain by Maquoketa Shale.

0.4 31.6 Note the talus blocks of Silurian dolomite.

0.2 31.8 On the right, note the Maquoketa Shale, a greenish, buff-colored, fine-grained shale.

0.3 32.1 Stop 5. Deer Plain and Brussels Terraces.

Terraces, formed by deposition of glacial outwash during the retreat of Pleistocene Glaciers from Illinois and adjacent areas, are very numerous along the Illinois and Mississippi Valleys in this area. The lower terrace at this location occurs at 440 to 460 feet above sea level and stands approximately 40 feet above the normal level of the Illinois River. This lower terrace here is called the Deer Plain Terrace for the village of Deer Plain in southern Calhoun County where the terrace is developed extensively.

The Deer Plain Terrace along the Illinois and Mississippi Valleys is a remnant of a former level of the valleys. Subsequent erosion has deepened and removed most of the Deer Plain sediments from these valleys.

The age and origin of the Deer Plain Terrace is still questioned. William W. Rubey wrote in Professional Paper 218 on the geology of the Hardin and Brussels Quadrangles that the Deer Plain Terrace in the Illinois Valley was formed as a result of deposition of outwash sand and gravel across the mouth of the Illinois River in the late part of the Wisconsinan Age of the Pleistocene Epoch. This dam of outwash sediments caused backwater or a temporary lake in the Illinois Valley. Silt and sand filled in the entire valley to the upper level of the Deer Plain Terrace.

A short distance to the east is another prominent terrace which also occurs extensively along the Illinois and Mississippi Valleys in this area. This terrace is older than the lower Deer Plain Terrace and is called the Brussels Terrace for the town of Brussels in southern Calhoun County. It occurs at 480 to 540 feet above sea level and was formed during the Illinoian Age of glaciation when a tongue of the ice extended across the Mississippi River at St. Louis. This ice dam across the Mississippi River created a lake in the Mississippi and Illinois Valleys north of St. Louis in which silt and sand was deposited to the upper level of this terrace.

1.5 33.6 Note the abandoned limestone quarry on the far right. The limestone quarry is in Silurian dolomite which is capped with fossiliferous Devonian limestone of the Cedar Valley Formation. In driving along this route, note that the toes of the hills have been completely washed away in our recent geological past. During the Pleistocene Epoch when great floods of water came down the Illinois River, much of the talus was washed away. Also during the Pleistocene, following the removal of the talus deposits, beds of silt, sand, and gravel accumulated in the valley only to be subjected to more recent erosion.

0.9 34.5 Note the peculiar vegetation on these hills. The vegetation is peculiarly adapted to the loess soils. The loess was blown out of the Illinois Valley during the Pleistocene Epoch.

.4 35.9 Road to Rosedale. Continue ahead on Rt. 100.

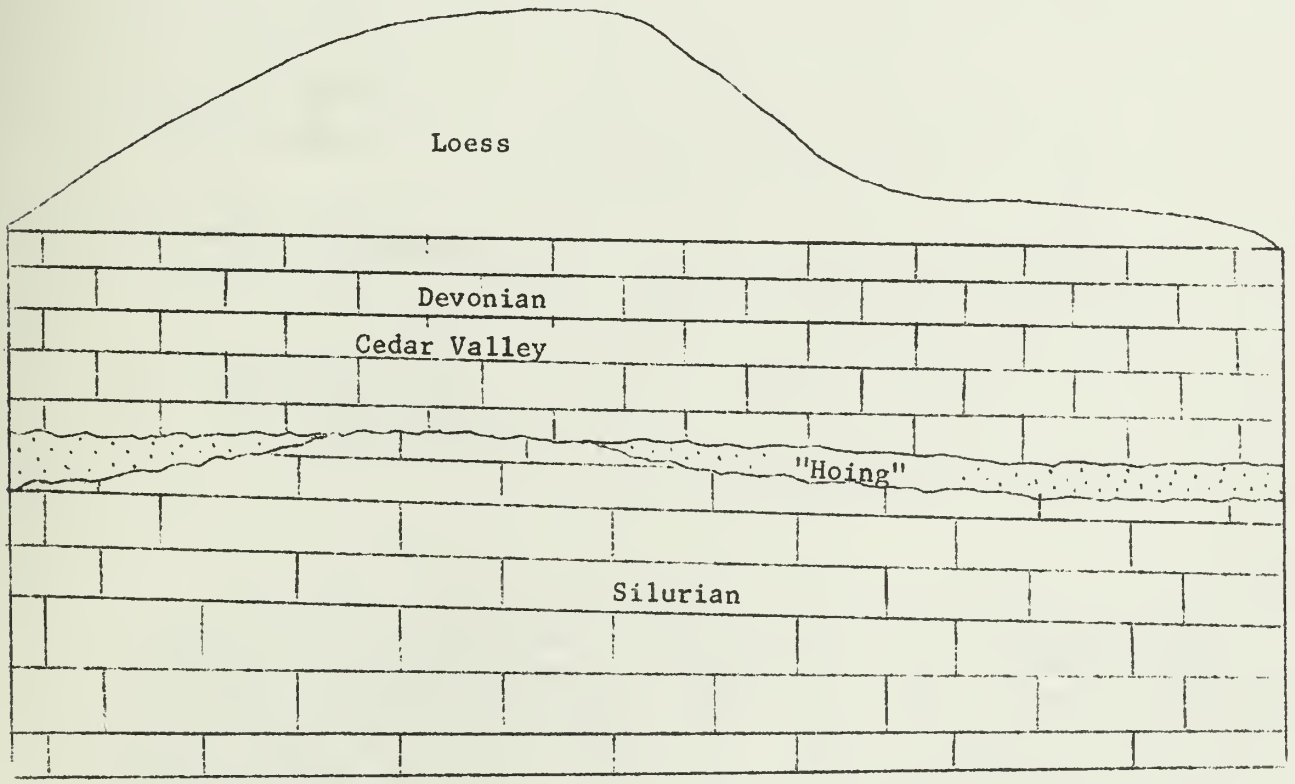
).2 36.1 Outcrop of Silurian dolomite on the right. Northward, because the rocks dip to the north, progressively younger and younger rocks are exposed in the valley wall.

1.3 37.4 Note the carving in the loess bluff on the right.

1.1 38.5 Note hill prairies directly ahead. These are typically shown here.

0.4 38.9 Stop 6. Nutwood. Leave car along Rt. 100. A few yards east of Rt. 100 on a limestone roadway, there is an interesting Devonian and Silurian section, which is as follows:

	Feet
Pleistocene	
Loess	10 plus
Devonian	
Cedar Valley Limestone, gray in color and with inclusions of shale, many fossils, including corals and brachiopods	14
"Hoing" Sandstone, medium to coarse grained with evidence of secondary growth of the grains, some doubly terminated quartz grains	0-2
Silurian	
Dolomite, buff to tan, granular, hard	8-10



The Cedar Valley Limestone of Devonian age is quite fossiliferous. Many large corals and brachiopods are found in it. Note the irregular contact of the Devonian on the Silurian here. This is one of the greatest unconformities, in terms of length of time represented, present in the geologic column of Illinois.

1.8 39.7 Note the terrace remnant over which the road passes and the broad expanse of the Illinois River Valley on the left.

0.4 40.1 Note the relative lack of talus along the east bluff of the Illinois River Valley. As previously noted, this is due to the great amount of erosion that took place in the Illinois Valley during the Pleistocene.

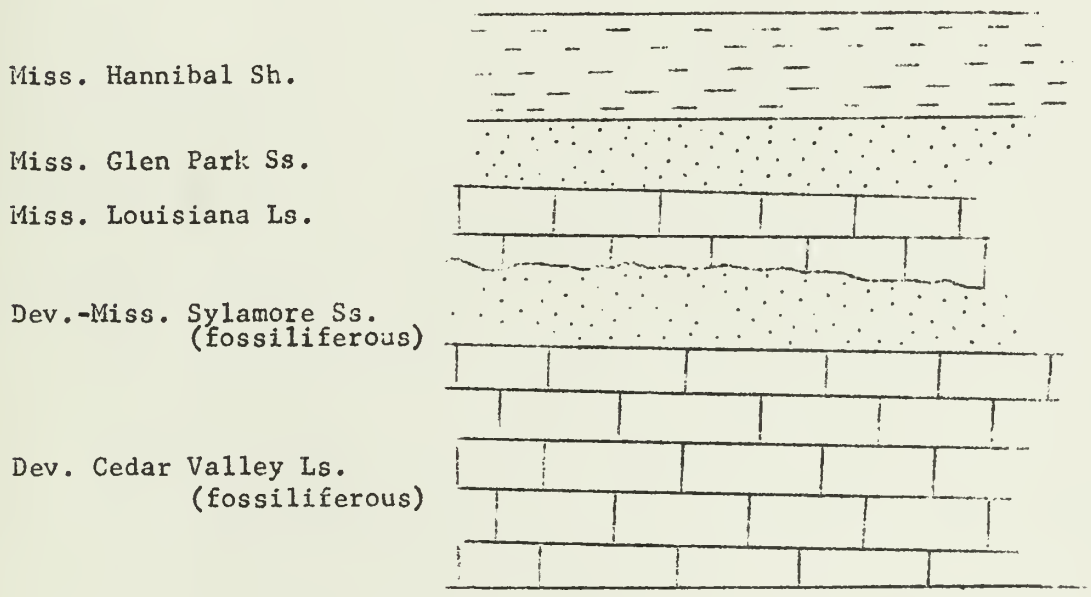
0.3 40.4 SLOW. Turn right.

0.1 40.5 STOP. Enter Rt. 16. CAUTION.

0.1 40.6 SLOW. Turn left.

0.2 40.8 Ford stream with CAUTION. Rocks on the right and left are of Devonian Cedar Valley Limestone.

0.1 40.9 Stop 7. Outcrops of Devonian Cedar Valley Limestone, Devonian or Mississippian Sylamore Sandstone, Mississippian Louisiana Limestone, Glen Park Siltstone, and Hannibal Shale.



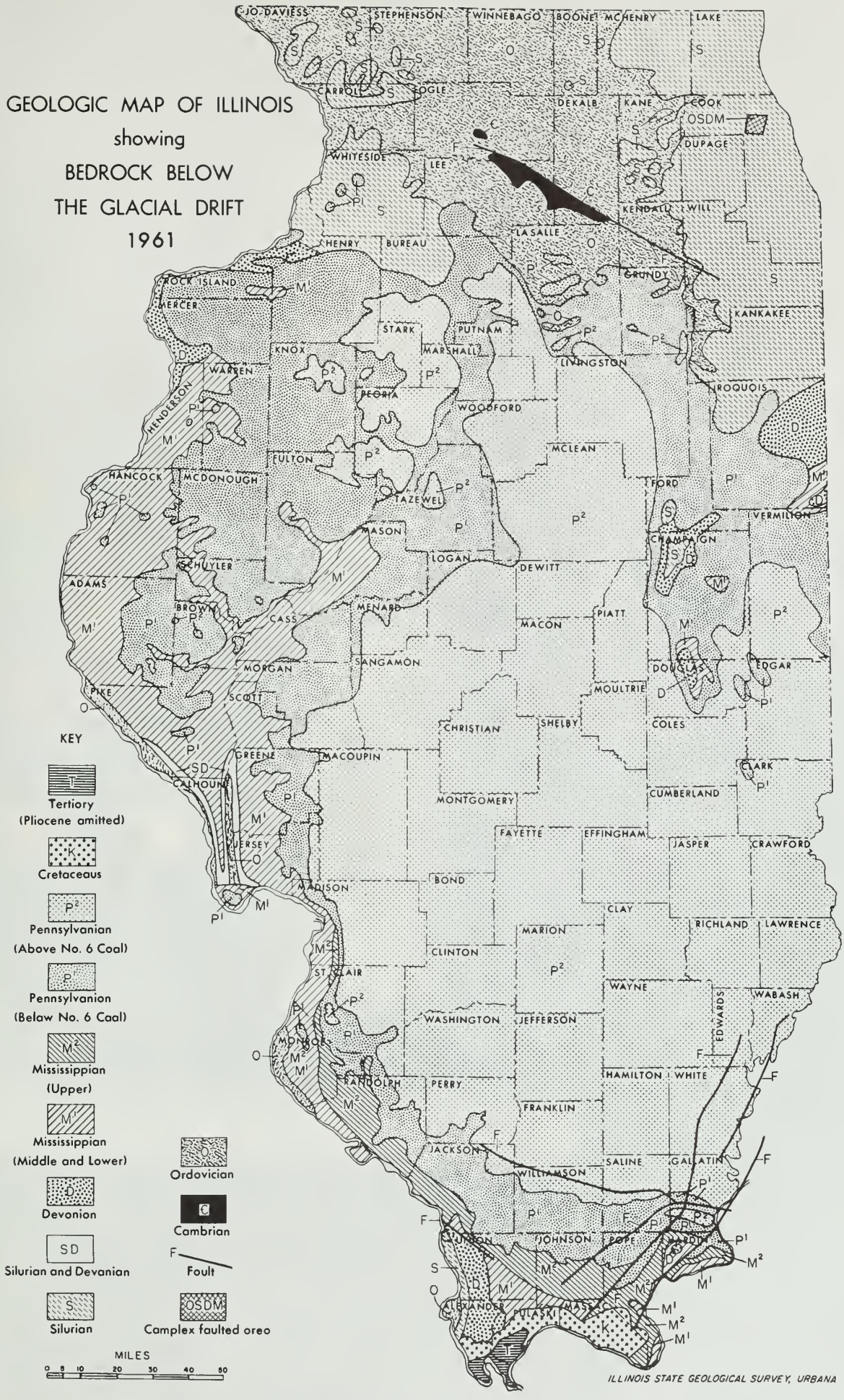
This is one of the best exposures of the Devonian Cedar Valley Limestone in the field trip area. The upper beds of this formation are a dark gray, fragmental limestone crowded with fossils of many varieties. The thin sandstone overlying the Cedar Valley, which is the resistant bed at the top of the small waterfall, also contains numerous fossils. A short distance upstream, a fine-grained, light yellowish, sublithographic limestone is encountered. This limestone is called Louisiana for Louisiana, Mo., where the formation was defined in 1892. Further upstream, Hannibal Shale is exposed in the creek bank.

Geologic Column
Jersey County

ERA	SYSTEM	SERIES	FORMATIONS AND REMARKS
Cenozoic	Quaternary	Pleistocene	See Pleistocene Time Table
	Tertiary		Pre-glacial gravels of polished chert
Mesozoic	Cretaceous		Present in extreme southern Illinois only
	Jurassic		Not present in Illinois
	Triassic		Not present in Illinois
Paleozoic	Permian		Not present in Illinois
	Pennsylvanian		Scattered outcrops mainly east of Grafton
	Mississippian	Chesterian	Not present in Jersey County
		Valmeyeran	Ste. Genevieve Ls. St. Louis Ls. Warsaw Sh. Keokuk-Burlington Ls. Sedalia Ls.
		Kinderhookian	Chouteau Ls. Hannibal Sh.
	Devonian		Sylamore Sandstone Cedar Valley Limestone - Hoing Sandstone
	Silurian		Dolomite chiefly of early Silurian Age, forms lower line of bluffs
	Ordovician	Upper	Maquoketa Shale, outcrops at base of Silurian bluffs
		Middle	Kimmswick Lis. Outcrops in Pere Marquette area
		Lower	No data available
	Cambrian		No data available
	Precambrian		No data available

TIME TABLE OF PLEISTOCENE GLACIATION
(after J. C. Frye and H. B. Willman, 1960)

STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
RECENT	Years Before Present	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
WISCONSINAN (4th glacial)	5,000 Valderan	Outwash	Outwash along Mississippi Valley
	11,000 Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500 Woodfordian	Drift, loess, dunes, lake deposits	Glaciation, building of many moraines as far south as Shelbyville, extensive valley trains, outwash plains, and lakes
	22,000 Farmdalian	Soil, silt and peat	Ice withdrawal, weathering, and erosion
	28,000 Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers, Winnebago drift
SANGAMONIAN (3rd interglacial)	50,000 to 70,000	Soil, mature profile of weathering, alluvium, peat	
ILLINOIAN (3rd glacial)	Buffalo Hart Jacksonville Liman	Drift Drift Drift, loess	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
YARMOUTHIAN (2nd interglacial)		Soil, mature profile of weathering, alluvium, peat	
KANSAN (2nd glacial)		Drift Loess	Glaciers from northeast and northwest covered much of state
AFTONIAN (1st interglacial)		Soil, mature profile of weathering, alluvium, peat	
NEBRASKAN (1st glacial)		Drift	Glaciers from northwest invaded western Illinois



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